ground squirrels transmitting plague infection to rats.

Remedial Measures.—These measures can be discussed under (*a*) eradicative measures and (*b*) control measures.

If it were possible to exterminate the ground squirrels the plague infection would be eradicated. However, when thought is given to the degree of infestation it will be realized that the extermination of these rodents is an impossible task. Certainly under the procedures now being carried on, the extermination of squirrels or the eradication of plague infection in them will not be accomplished.

The only method of eradication of plague among squirrels that appears to the writer, is an intensive shooting campaign over large areas for the purpose of determining foci of infection, and then intensive work for the extermination of the squirrels at and around these foci of infection. Such a campaign would be expensive and necessitate much larger appropriations than are now being made, but such expenditures, even if large, would be economy in the end and would accomplish results impossible to obtain under past or present procedures. Under this plan it is believed that plague infection could be eradicated. The destruction of squirrels in noninfected areas would resolve itself into an economic problem.

The State Department of Health is the logical agency to carry out these operations, and sufficient appropriations should be allowed that organization to permit of an extensive shooting campaign to determine foci or plague among ground squirrels. A start in that direction was made last year, and it is understood that a similar campaign will be carried out this year. However, sufficient funds should be made available to enable the prosecution of intensive work.

After the determination of foci or plague infection it might be possible, through the Horticultural Commissioners of the counties, to have enacted intensive eradicative measures around such determined foci.

If the ideal is unobtainable, what control measures can be employed to effect a reasonable degree of safety? This objective can be obtained by local intensive operations for the purpose of bringing about squirrel-free zones around centers of population, especially around the cities. Furthermore, this measure should be carried out around towns, villages, schoolhouses, and rural dwellings. The work carried out at the present time is localized control and not eradicative.

Plague in Urban Communities.—This discussion would be incomplete without some reference to plague in cities and towns, as remedial measures which are different from those employed against ground squirrels would have to be directed against rats.

It is of paramount importance in cities infected or that have been infected with plague to institute those measures which experience has taught are essential either in the eradication of plague, or for placing such communities in a sanitary condition from a plague standpoint that would render them less infectible, and to facilitate the eradication of the disease if lodgement should occur.

The only efficient measure is the rat-proofing of buildings and the destruction of rat harborages. This cannot be too strongly emphasized, and all seaport cities should have such ordinances in effect; and, furthermore, these ordinances should be rigorously enforced by the health departments of such communities.

Cities that have been infected with plague must be regarded as liable to reinfection unless proper rat-proofing of buildings has been carried out.

The second measure that should be practiced in cities that have been infected with plague is a continuous rat survey, and this should be sufficiently extensive to give a fair cross-section of the rodent population. This will prove of marked value from both a public health and economic standpoint. It would give early information of any foci of infection and permit of prompt eradication before the disease had spread. The economy that would result from this practice can be easily visualized.

The task is stupendous, but as the work prosecuted against ground squirrels, with varying degrees of intensity for nineteen years, has not eradicated the infection in many of the counties in which it has been proven, it seems imperative that more vigorous action should be taken to eliminate this potential danger.

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EMOTIONAL INFLUENCE UPON THE GASTRO-INTESTINAL TRACT*

By HOWARD E. RUGGLES, M. D.
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DISCUSSION *by Raymond G. Taylor, M. D., Los Angeles; Orrin S. Cook, M. D., Sacramento; Robert R. Newell, M. D., San Francisco.*

EVIDENCE of the close connection between the nervous system and the gastro-intestinal tract is always before us. Sinking feelings upon the receipt of bad news; the sudden epigastric cramp just before an automobile accident, and the often quoted relaxation of sphincters at moments of great fear are known to everyone. The organic changes associated with these states have not been demonstrated roentgenologically. But the intestine is equally responsive to emotional stimuli of lesser degree, and the signs of their presence are constantly before us upon the fluoroscopic screen.

CONFIRMATORY HISTORIES

The chairman's address before the medical section of the American Medical Association last year dealt with this subject, and he mentioned the following case:

An apparently normal business man developed an obstruction in his sigmoid during an emotional crisis where he had to sacrifice either his principles or his position. Opaque enema showed a complete block, and the patient only escaped

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laparotomy because his physician was wise enough to repeat the examination several times.

Within the year a woman was sent to operation because of an irregular defect in the ascending colon, seen on different days, to find the area perfectly normal when the abdomen was opened. She was an extremely nervous individual with a long surgical history, and insufficient emphasis had been put on that side of the story.

Recently I was much impressed by the extreme degree of spasm in the sigmoid and descending colon of a woman surgeon. It took fifteen minutes to outline the colon by enema, owing to a marked general constriction. I ascribed the condition to apprehension over the possibility of a malignancy, as she had just had two cases of carcinoma of the colon in particularly important patients. The fact was that she was suppressing a blow to her pride. The family of one patient had called in another surgeon, although she had always cared for them previously. The effort to keep the hurt out of her consciousness tied her colon in a knot.

A patient with a rather atonic stomach was returned to her dressing room for a few minutes to permit another examination to be completed. She became enraged at this procedure and when she again appeared behind the screen her stomach had lifted, contracted to half its former size and showed rapid, vigorous peristalsis. The stomach subsided with her anger and soon returned to its normal state.

THERAPEUTIC APPLICATION

There is a practical application of mental control of the pylorus. Frequently when the duodenal cap is slow in appearing, a short conversation with the patient on the subject of favorite foods will produce a prompt relaxation of the pyloric sphincter.

At least one-third of our gastro-intestinal patients have no organic lesion, yet their symptoms are sufficiently important to send them to a physician. If their nervous systems are moderately stable and the inciting factor is removed, they return to normal health in time. But that great collection of unfortunates with a substandard mental and nervous equipment or those whose environment produces a chronic emotional strain, we have with us always. You have all seen patients who go along comfortably but return with another duodenal ulcer as soon as an additional load is thrown upon them in the way of worry, fear, or overwork. It is at times difficult, in the brief acquaintance we have with these patients, to dig out the causative factor, but it is time well spent to do so. Where we find unusual spasm or stasis present the nervous background should always be investigated. It is of the greatest importance to repeat the roentgen examinations on such individuals. The most characteristic finding with them is the variability of the picture from hour to hour and from day to day.

Fifteen years ago Cannon pointed out the profound changes which fear, pain, and rage produce in laboratory animals—the relaxation in stomach, small intestine and colon, dilatation of the pupils, acceleration of the heart, pallor, increase in blood sugar, and the other sympathetic nerve effects. His ingenious explanation classes them as reflexes and assumes that their purpose is to assist the individual in times of conflict. In our present existence the conflicts are no longer physical but mental. However, they call for the same visceral responses which may be marked in emotional or hypersensitive individuals.

DISTRIBUTION OF INVOLUNTARY NERVOUS SYSTEM

The distribution of the involuntary nervous system is of considerable interest. The esophagus and cardiac end of the stomach are supplied entirely from the craniosacral division. The sympathetic first appears in the pyloric end of the stomach and both systems continue to the ileocecal region. Practically all the large intestine is innervated by the sympathetic. The lower sigmoid and rectum have both. In general the sympathetic is inhibitory and the craniosacral motor in effect, but variations from the rule are frequent. The areas of particular importance, from our standpoint, are those where the two sources of supply overlap—about the pylorus, in the ileocecal region and the sigmoid. Except for the descending colon the sections supplied by one system alone show little evidence of emotional influence. My impression is that men are more apt to show mental strain about the pylorus, and women in the colon. Brunswick investigated the effects of emotional stimuli on the stomachs and rectums of a small series of medical students. He found in general that decreased tone accompanied unpleasant emotional states and pleasant ones caused an increase. Disgust was an exception, producing an increase. Study of the gastro-intestinal tracts of a series of mental cases gave interesting results. In actively hallucinating paranoid schizophrenics, where the most intense emotions are experienced which continue for long periods of time, stomachs are atonic and colons slow in emptying, due to sympathetic stimulation. Of all portions of the tract the colon is most susceptible to sympathetic control.

It is of interest in this connection to review the question of ulcer. No matter what one may feel to be the cause of ulcer, it cannot be denied that there is a great nervous element in many of them. The tendency to recurrence under stress—the association of ulcer with a fairly characteristic type of personality and the chronicity of the lesions when the emotional background cannot be controlled are suggestive. Recently Stahnke, by stimulation of the vagus, has been able to demonstrate a neurogenic regulation of the form and position of the stomach in dogs. Chronic stimulation produced defects in the gastric mucosa and alterations in acidity.

Wilkie, in Great Britain, found duodenal ulcer in men three times more common than in women. Nolke's figures in Germany are four to one, and in our series of nine thousand gastro-intestinal cases, covering six years, there are twelve hundred ulcers, also at a ratio of four to one. Gas-

tric ulcers are one-twelfth as common as duodenal and they are distributed two to one in favor of the men. This difference in distribution may be assumed to be due to the greater stress of modern life upon the male or, what seems more likely, to a greater tendency for emotional impulses to spread through the sympathetic system in the female and the craniosacral in the male. Certainly we see more atonic stomachs and intestines in women than in men.

Spasm of the colon in a mild form is the most common cause of constipation and as such is a matter of great concern to a large portion of our population. Most colons would perform more satisfactorily if allowed to go their own course without interference. In a rough way the tone of the colon corresponds to the general nervous tension. In times of stress we see either local or general spasm most evident in the sigmoid. It may be of some significance that diverticula (except the congenital form) are prone to occur at the common sites of spasm. They may be the late results of chronic constriction.

In our experience antispasmodics have little influence upon these conditions. Nitrites are sometimes useful but, like atropin, are erratic in their effects. Theoretically sedatives should be much more effective. We have had some success with luminal and it may prove valuable.

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DISCUSSION

RAYMOND G. TAYLOR, M. D. (Hospital of the Good Samaritan, Los Angeles).—We are indebted to Doctor Ruggles for presenting this important but neglected angle of gastro-intestinal disease or symptoms. While there are no rules to govern, it would seem that his suggestion to repeat the examination when no organic lesion is found, or when one is in doubt, is a good one. My experience would lead me to believe that the most common point for spasm engendered by the emotions is in the lower descending colon rather than in the sigmoid.

I agree heartily with Doctor Ruggles that the ordinary antispasmodics are unreliable and of but little use. Considerable personal experience with luminal, especially in spasm of the colon, leads me to believe it more often produces results than the more commonly used drugs.

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ORRIN S. COOK, M. D. (Mater Misericordiae Hospital, Sacramento).—This is a timely paper on an important subject about which very little has been written.

I have recently seen three patients, two of whom were high-pressure business men, with quite marked gastro-intestinal symptoms. The only x-ray findings were marked spasm and irritability of the colon, and symptoms were relieved entirely by appropriate treatment. The third patient was a very nervous woman, who had had her appendix removed for the same symptoms without relief, and in whom the x-ray findings were the same as in the two men.

Undoubtedly patients are at times subject to surgery whom the roentgenologist may save from unnecessary operation if he will bear this condition in mind.

❦

ROBERT R. NEWELL, M. D. (Stanford University Hospital, San Francisco).—Doctor Ruggles has made an interesting entry on a difficult field. Morbid physiology is a much less steady foundation for diagnosis than is morbid anatomy. This is partly because it is less narrowly topical. Due to the functions of the nervous system and the hormones carried by the blood, disease in one location may cause disturbance of physiology at other locations, sometimes very remote ones.

If the roentgenologist desires merely to make diagnoses wherever possible, he will perhaps wisely limit his observations to evidences of anatomical lesions. But if he has a broader view of his obligations, if he wishes to be of maximum service to his clinical consultant, he will note and report also the variations in constitution and in physiology which his methods may reveal.

That disturbed physiology from remote causes may at times lead to mistaken diagnosis cannot be denied. Doctor Ruggles has cited some interesting instances. But I do not believe these are frequent. More often we find these functional disturbances interfering with our roentgenoscopic visualizations without actually misleading us. We are loath to call a viscus anatomically intact until we can see it in its entirety. That these functional obstructions to roentgenological certainty can often be removed by attention to the patient's emotional state is, I think, the most important thing in Doctor Ruggles' paper. We will be well rewarded when we take the time to repeat unsatisfactory gastro-intestinal examinations and exhibit the sympathy necessary to relieve unsatisfactory emotional states. I have been dumbfounded at the miraculous effect sometimes observed in a stubborn pylorus following a minute's conversation on the subject of good things to eat.

In regard to antispasmodics, they may be two-edged. That a certain sign disappears temporarily on antispasmodic medication does not prove it to be of no importance. I believe it is often possible to relieve the topical spasm of duodenal ulcer by full doses of atropin.

PSYCHIATRY IN ACTION*

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DISCUSSION *by G. E. Myers, M. D., Los Angeles; Edward W. Twitchell, M. D., San Francisco; Joseph Catton, M. D., San Francisco.*

A LITTLE more than one hundred years ago the mentally sick were lifted from their loose straw and dungeons to mattresses and prison cells. About 1840 the medical superintendents in Pennsylvania and the East advocated and practiced a plan of treating and curing the mentally sick that compares favorably with modern methods. But it was not until the nineties that hospital care and treatment was generally adopted. In 1909 Mr. Clifford Beers formed the National Mental Hygiene Society and introduced community standards and plan as opposed to the institutional and political plan. In 1912 Dr. E. E. Southard in the Boston Psychopathic Hospital adopted the ideal of a community hospital and community service. Since then in rapid succession have followed outpatient clinics from Maine to California, and even traveling clinics in Iowa, Colorado and a few other places. Since 1922 child guidance clinics have been established from coast to coast and have contacted and coöperated with schools, social agencies, juvenile courts, and problem children in homes. Industry has found it profitable to employ full-time psychiatrists to care for the mental

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